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A simulation model of intake of grazing cattle in homogeneous environments

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A mechanistic and dynamic model to examine the ingestive behaviour and intake of grazing cattle, in relation to sward characteristics, was developed. The model provides a framework to consider the restriction of intake, due to sward canopy structure in a wide range of situations, in order to incorporate these aspects into alimentation models at a later date.

The model runs in a Quattro Pro 4.0 spreadsheet. Sward variables (aerial biomass, height, bulk density of grazing horizons, cover, leaf/stem ratio, barriers to bite depth, digestibility), and animal variables (live weight, breed, frame, sex, maximum grazing time, allowance, selectivity), are used to predict the bite dimensions (area, depth, weight), intake rate, biting rate, diet digestibility, intake and grazing time at the grazing horizon level, during one day, and also for a longer period of time.

The model shows the limitations of empirical functions between intake/biomass or intake/allowance. It highlights the sensitivity of the outputs to changes in the canopy structure, underlining the need for an adequate spatial description of the consecutive grazing horizons. Variations in animal characteristics allow an increase in the range of applicability and explains behavioural changes between different animals and pastures. Progressive defoliation and stocking rate permit the analysis of the daily ingestive behaviour, and for longer time periods permit the analysis of the extent and rate of the changes that are produced during the grazing time when the animal grazes down. Model bite weight and rate of intake predictions closely fitted the results from experiments , against which they were tested, with : r2 = 0.90, Sy/x = 0.07 g MS and r^2 =0.70, Sy/x = 5.80 g MS/minute, respectively.

The model enables identification of the key elements of the plant-animal interface which require more detailed studies. The model is useful when intake rate or grazing time limits daily intake, a situation which often occurs in grazing systems with a high efficiency of utilization.